

## Site Need Statement

<b>General Reference Information</b>	
1 *	<b>Need Title:</b> Advanced Immobilization for LAW to Reduce BOM Cost
2 *	<b>Need Code:</b> RL-WT121
3 *	<b>Need Summary:</b> Development and knowledge of complimentary waste forms to borosilicate glass for immobilizing of low-activity waste could reduce RPP life cycle costs and accelerate the completion of the balance of mission. These waste forms could potentially be used to immobilize waste not suitable, or cost-effective, for treatment by the initial Phase 1 baseline plant and could avoid the need for a second LAW vitrification plant.
4 *	<b>Origination Date:</b> FY 2001 (November 27, 2000)
5 *	<b>Need Type:</b> Technology Need
6	<b>Operation Office:</b> Office of River Protection (ORP)
7	<b>Geographic Site Name:</b> Hanford Site
8 *	<b>Project:</b> Office of River Protection - Treat Waste Balance of Mission <span style="float: right;"><b>PBS No:</b> ORP-TW07</span>
9	<b>National Priority:</b> ____ 1. <u>High</u> - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule. <u>X</u> 2. <u>Medium</u> - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays). ____ 3. <u>Low</u> - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success.
10	<b>Operations Office Priority:</b>
<b>Problem Description Information</b>	
11	<b>Operations Office Program Description:</b> To perform the activities necessary to remediate the Hanford tank waste, DOE assigned responsibility to the Office of River Protection (ORP) in Richland, Washington. DOE has extended a contract for the design, construction, and commissioning of a new Waste Treatment and Immobilization Plant (WTP) that will treat and immobilize the waste for ultimate disposal. The WTP is comprised of four major elements, pretreatment, LAW immobilization, HLW immobilization, and balance of plant facilities.
12	<b>Need/Problem Description:</b> The Hanford River Protection Project is proceeding with the design and construction of the Waste Treatment Plant for high-level and low-level waste vitrification. Under the current schedule plan, well-defined borosilicate waste forms and joule-heated melter technology has been selected to immobilize 10% of the Hanford LAW waste volume by 2018. While this initial Waste Treatment plant has a design life of 40 years, additional LAW immobilization capacity is needed to treat all of the Hanford LAW during the balance of mission.  For the remaining waste to be immobilized in the balance of mission, significant reductions in the life-cycle cost and schedule could be achieved with an improved LAW form. The concentration of Hanford LAW that can be immobilized in borosilicate glass is primarily limited by the allowable concentrations of sulfur and sodium in the melter feed. Improved glass or crystalline (mineral or synthetic) waste forms that can incorporate these components along with the rest of the LAW waste feed are desirable. A suitable alternative waste form must be capable of forming a stable, durable material with a minimum of waste dilution. The waste must be easy to process under remote handling conditions and should not be corrosive to melters or other processing equipment. The waste form must be able to be processed in the existing LAW vitrification facility or be fashioned to be retrofitted into the facility or auxiliary facility at a cost that is significantly lower than the construction of a new LAW vitrification facility.
13	<b>Functional Performance Requirements:</b> To assure significant gains over that expected from the current

	process, improved waste forms and their processing equipment should achieve twice the throughput at the same or reduced cost. In addition, the improved waste forms will need to meet the intent of the ILAW product specifications (e.g., chemically stable waste form in a compact and durable disposal package) and be acceptable in terms of final ILAW volume, maturity of technology, ability to install in a shielded facility, waste form chemical and physical stability, life cycle cost, stakeholder acceptability, and time required to deployment. The waste form must be compatible with the Hanford site near surface burial facility in that it must meet or exceed all release requirements for that facility and not adversely impact other facility components (e.g., the borosilicate glass). In addition, the waste form must meet land disposal requirements.
14	<b>Definition of Solution:</b> Acceptable solutions will be achieved when waste forms have been developed and demonstrated to meet the requirements, and when processing technologies have been developed, demonstrated, and evaluated at roughly 1/10 full scale.
15 *	<b>Targeted Focus Area:</b> Tanks Focus Area (TFA)
16	<b>Potential Benefits:</b> A limited number of superior waste forms can significantly reduce costs by increasing the capacity and flexibility of the baseline treatment plant, minimizing final waste volumes, and simplifying pretreatment processes. Waste forms with comparable chemical durability to borosilicate glass can reduce the risk of contamination to the environment. Insertion of improved technology prior to treating the balance of mission waste could avoid the construction of a second LAW vitrification facility.
17	<b>Potential Cost Savings:</b> LAW vitrification cost savings would include avoidance of ~\$520M in capital construction costs for a second facility plus reduced operating and ILAW disposal costs.
18	<b>Potential Cost Savings Narrative:</b> With the WTP annual operating cost expected to be in the hundreds of millions of dollars, minimizing plant start up or down time will be a key potential savings, easily measured in the tens of millions of dollars.
	<b>Technical Basis:</b> Current baseline technology requires waste forms to be produced with reduced waste loadings as a compromise to the technology. Resolution of this need will significantly increase WTP flexibility and technical and economic performance.
19	<b>Cultural/Stakeholder Basis:</b> The River Protection Project is committed to moving forward to design, construct, and put into operation the Waste Treatment and Immobilization Plant on the schedule recently agreed to in the Tri-Party Agreement to treat the initial 10% of the waste. A key element for completing treatment of the remaining all of the Hanford waste is to reduce the life-cycle cost through inclusion of improved technologies.
20	<b>Environment, Safety, and Health Basis:</b> Reduced ILAW packages reduce the risks to workers and the environment. Reduced operating periods will reduce worker exposure and a reduced facility life.
21	<b>Regulatory Drivers:</b> Environmental Impact Statement (EIS) for the Tank Waste Remediation System (TWRS) (DOE-RL and Ecology 1996) and the Hanford Federal Facility Agreement and Consent Order (known as the Tri-Party Agreement) and its amendments. DOE has negotiated additions to the Tri-Party Agreement that require the retrieval of single shell tanks by 2018, and the startup and operation of the WTP to support the treatment and immobilization of tank waste. By operating the WTP not only is that capability demonstrated and about 10% by volume (25% by activity) of the tank waste processed, but space is made available in the double shell tanks to allow the single shell tank retrieval to proceed without the expenditure for additional double shell tanks. Other regulatory drivers include gathering the data necessary for the regulatory permits required for the startup and operation of the facility.
22 *	<p><b>Milestones:</b></p> <p>Tri-Party Agreement commitments:</p> <ul style="list-style-type: none"> <li>• Start (Hot) commissioning-Phase I Treatment Complex 12/2007</li> <li>• Start Commercial Operation-Phase I Treatment Complex 12/2009</li> <li>• Complete Phase I-Treatment (no less than 10% of the tank waste by volume and 25% of the tank waste by activity) 12/2018</li> </ul> <p>Other selected TPA milestones are:</p> <ul style="list-style-type: none"> <li>• Immobilize remaining tank waste 2028</li> </ul>

	<ul style="list-style-type: none"> <li>• Close all tanks 2032.</li> </ul>
23 *	<b>Material Streams:</b> ID-3857 HLW to Treatment Risk Score: 3
24	<b>TSD System:</b> Hanford Waste Treatment and Immobilization Plant
25	<b>Major Contaminants:</b> Fission products, actinides, nitrate
26	<b>Contaminated Media:</b> Tank waste consisting of supernate (liquid), salt cake, and sludge.
27	<b>Volume/Size of Contaminated Media:</b> The Hanford Site has 177 underground tanks that store 204 million liters (54 M gallons) of waste containing about 190 MCi of activity.
28 *	<b>Earliest Date Required:</b> Early technology insertion is possible if completion occurs by 2005
29 *	<b>Latest Date Required:</b> To support Phase 2 operations, a FY 2008 completion date will be required.
<b>Baseline Technology Information</b>	
30	<p><b>Baseline Technology/Process:</b> The current technology is a joule-heated melter that employs bubblers to increase production rates. Current technologies will product an estimated 72,000 containers (185,000 m<sup>3</sup>) of ILAW. Plant operations will be completed between 2028 and 2040.</p> <p><b>Technology Insertion Point(s):</b> N/A</p>
31	<b>Life-Cycle Cost Using Baseline:</b> The current baseline for the WTP is several billion dollars, with the BNI estimate itself is in the \$4 billion range. The current River Protection Project life cycle costs are estimated at approximately \$50 billion.
32	<b>Uncertainty on Baseline Life-Cycle Cost:</b> There is large uncertainty in the WTP life-cycle cost, providing the opportunity to reduce the life-cycle cost due to operation improvements as well as ensuring operational success not to add additional cost to the system.
33	<b>Completion Date Using Baseline:</b> Plant operations will be completed between 2028 and 2040.
<b>Points of Contact (POC)</b>	
34	<b>Contractor End User POCs:</b>
35	<p><b>DOE End User POCs:</b>  R.(Rudy) Carreon, DOE-ORP, 509-373-7771, F/509-373-0628, <a href="mailto:Rodolfo_Rudy_Carreon@rl.gov">Rodolfo_Rudy_Carreon@rl.gov</a>  E.J. (Joe) Cruz, DOE-ORP, 509-372-2606, F/509-373-1313, <a href="mailto:E_J_Cruz@rl.gov">E_J_Cruz@rl.gov</a>  B.M. (Billie) Mauss, DOE-ORP, 509-373-5113, F/509-372-2781, <a href="mailto:Billie_M_Mauss@rl.gov">Billie_M_Mauss@rl.gov</a></p>
36 *	<p><b>Other Contacts</b>  S.A. (Steve) Wiegman, DOE-ORP, 509-372-2536, F/509-372-2781, <a href="mailto:Stephen_A_Wiegman@rl.gov">Stephen_A_Wiegman@rl.gov</a>  M.E. (Michael) Johnson, CH2M HILL Hanford Group, Inc., 509-372-3628, F/509-376-1788,  <a href="mailto:Michael_E_Johnson@rl.gov">Michael_E_Johnson@rl.gov</a></p>

\*Element of a Site Need Statement appearing in IPABS-IS